Patent Application of

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for

METHOD OF MAKING A REPETITIVE OR NON-REPETITIVE MODULAR WEAVE DESIGN

BACKGROUND

This Application claims the benefit of Provisional Patent Application Ser.# 60/397,519, filed 2002 July 22.

BACKGROUND—Field of Invention

The present invention relates to designs and provides a method of making a unique weave design that has many practical applications.

BACKGROUND—Description of Prior Art

It has been known, in the prior art, to make designs from a plurality of blocks or squares. Thus, U.S. Pat. No. 1, 453,728 shows a method of making an ornamental design from a set of squares, the design being built up from selected portions of circular arcs. U.S. Pat. No. 1,973,564 discloses a set of blocks, each having different patterns, the blocks being assembled to form ornamental designs.

Other patents showing the use of blocks or squares to create larger designs include U.S. Pat. Nos. 741,142, 1,268,391, 2,881,537, and 3,464,145. U.S. Pat. No.

3,755,923 shows a design that includes identical and regular polygons in some cases and non-identical and irregular polygons in other cases. U.S. Pat. No. 3,643,956 shows a design having identical polygons with bilaterally symmetrical single line designs. The square members of US patent 3643956 contain some similar features such as separated and contrasting fields within the element that form the perception of a path. However, the uniqueness of the present invention is that elements placed together form a weave design. More than one path crossing per edge of the element is possible in the modules of the present invention. Non-square elements and elements with non-straight edges are also possible.

U.S. Pat. No. 5,011,411 shows a method for making a non-repetitive design, the design being formed of a large number of substantially identical squares or polygons. However, the designs on these polygons yield patterns that are layered one over the other without variation. The present invention improves on the prior art by using the alternating over and under passage of linear elements to yield a weaving pattern. Thus, virtually every possible orientation of the modules yields a meaningful variation of the weave design without disturbing the weave appearance. The weaving designs made according to the present invention can therefore be realized with virtually endless variety. One advantage of modular construction is that the weave design can be mass-produced and attached permanently to a solid substrate. Moreover, comparatively unskilled persons can install the weave designs made according to the present invention, because the orientation of the modules is not critical and, in fact, creates a variety of weave designs. These weave designs can be made repetitive or non-repetitive by simply choosing the orientation of the modules.

OBJECTS AND ADVANTAGES

It is therefore an object of the invention to provide a method of making a multiplicity of weave designs which are formed of a plurality of substantially identical modules.

It is another object to provide a method of making a modular weave design that is repetitive or non-repetitive across a given area.

It is another object to provide a method of making a modular weave design that exhibits continuity from one module to the next.

It is another object to provide a method of making a large weave design which is made of a set of smaller modules, and wherein the appearance of the larger weave design is, in general, substantially different from that of the module.

It is another object to provide a method of making a repetitive or non-repetitive modular weave design which can be realized in a virtually endless variety of ways.

It is another object to provide a method of making a repetitive or non-repetitive modular weave design which can be created and/or assembled by persons having limited artistic ability, or by computers.

It is another object to provide a method of making a repetitive or non-repetitive modular weave design with modules which have edges that are not straight, but still exhibit the ability to provide a continuous weave design when assembled.

It is another object to provide a method of making a modular weave design, the modules of which can be produced in quantity, for attachment to a solid substrate, so as to provide designs for furniture and interior structures, and to decorate other surfaces.

It is another object to provide a method of making a modular weave design, the modules of which can also be used to make toys and games.

An advantage of the present invention is that each orientation of the element results in preservation of the weave pattern from one element to the next.

Another advantage of the present invention is that users may orient the modules in many ways, resulting in many unique weave designs.

The present invention has the additional advantage that it can be practiced by virtually anyone, even by persons having limited artistic talent. Once the module has been created, simply arranging the modules to cover a surface forms the overall weave design.

Other objects and advantages of the present invention will be apparent to those skilled in the art, from a reading of the following brief description of the drawings, the detailed description of the invention, and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a drawing of a square module of area bearing a portion of a weave design, which is made using the present invention, and which can be used to make a weave pattern that is repeating or non-repeating.

FIGS. 2a and 2b are drawings showing dissimilar weave designs in assemblies of identical square modules of area made using the present invention.

FIGS. 3 to 7 are drawings showing the method of the present invention when applied to a square module of area.

FIGS 8 to 11 are drawings showing the method of the present invention when applied to a triangular module of area.

FIG 12 is a drawing showing the present invention when applied to a module of area having a curved edge.

FIG. 13 is a drawing of an assembly of square modules of area made according to the present invention and assembled into a paver-stone patio for landscaping.

LIST OF REFERENCE NUMERALS

1. String
2. Background
3. Module of area oriented the same as all others.
4. Module of area rotated 90 degrees from original orientation.
5. String
6. String
7. String
8. String
9. Square boundary superimposed over arranged strings
10. Triangular boundary superimposed over arranged strings
11. Curved edge of 4-sided module of area

SUMMARY OF THE INVENTION

The present invention is a method by which one may create a module of area bearing the visual design of woven string segments and assemble a collection of the modules of area to create an overall weave design over a surface. The assembling of the modules can be done with similar or randomized orientations to create or to avoid repetition in the overall weave design without disturbing the proper weaving behavior of the strings in the design.

DETAILED DESCRIPTION

The present invention is a method of making a repetitive or non-repetitive modular weave design for a surface. By "modular", it is meant that the design is formed from a plurality of substantially identical elements or modules of area. The

term "non-repetitive" means that it is possible to find two regions of the surface having designs which are different.

Figure 1 is a drawing of a square module of area as an embodiment of the present invention bearing the image of woven strings (1) over a background (2). The design can be made with modules of area having the shape of any regular polygon which, when combined with other polygons having the same size and shape, can cover a given surface area without leaving "holes". The design can also be made with modules of area having shapes based on regular polygons with bilaterally-symmetric non-straight edges such as an "s" shape which when combined with other similar shapes can cover a given surface area without leaving "holes".

Figure 2a shows an assembly of nine of the same modules of area from Figure 1, all arranged in the same orientation to create a repetitive weave pattern. The center module of area (3) is shown oriented the same as all others in the assembly. Figure 2b shows nine of the same modules of area arranged with random orientations to create a non-repetitive weave pattern. The center module of area in the assembly (4) is rotated 90 degrees counterclockwise from the original orientation.

The design of each module of area can be created in the following manner. First, start by randomly arranging a collection of strings on a flat surface as shown in Figure 3. The strings in the figure are (5), (6), (7), and (8). Next, arrange the intersections of the strings in a woven pattern so that each string alternately passes over and under those it intersects. Do this operation while preserving randomness in the arrangement. A segment of this weave pattern will provide the basis for a module of area. Figure 4 shows strings arranged in such a relationship. String (5) has been routed under String (7) while kept over String (8), and the end of String (5), which originally intersected String (6) in Figure 3 is routed so that there is not an intersection.

Establish a boundary around a portion of the weave pattern in the shape you wish to use for the module of area. Figure 5 shows a square boundary (9) superimposed over the randomly arranged woven strings.

Move the strings that pass through the boundary so that their intersections with the boundary are evenly divided between the edges. Strings may need to be added or taken away to accomplish this division, and if this is necessary, make sure to

provide the woven intersections over and under the other strings. Figure 6 shows the strings' boundary intersections divided between the edges evenly. Note that Strings (6) and (7) have intersections with the square boundary that are moved to accomplish this.

Arrange the intersections of the strings with the edges so that on an edge, the intersections are spaced evenly from the midpoint of the edge. Also, make sure that the intersections to the edges form an angle perpendicular to the edge. This will provide the basis for a simple element, but a more complex version can be made with intersections at other angles, provided that from one edge to the next, the intersections' angles are repeated around the boundary on each edge. For simplicity, the perpendicular angle intersections will be used in this description. From one edge to the next, arrange the spacings so that they are identically spaced. This will ensure that regardless of the orientation of a particular element, the overall pattern of multiple elements will have continuity of the weave pattern across the element boundaries. Figure 7 shows the module of area with the string intersections with the edges properly spaced around the boundary. Figure 7 is now a module of area that can be used to create a weave design that is repetitive or non-repetitive.

The module of area produced according to the method described above is then duplicated, and the result is a plurality of substantially identical modules. These modules are then arranged with similar or random orientations to cover an arbitrary surface. When so arranged, the modules form a larger weave design, which, in general, appears quite different from the design of the individual modules. The symmetry of the placement of the string intersections on the edges of the boundary insures that the design will have continuity from one module to the next. Although the original module is asymmetric, the pattern formed by the plurality of identical modules exhibits a surprising degree of continuity.

Place a multiplicity of the modules of area such as those in Figure 7 onto the surface to be covered to create a weave pattern. If desired, place the modules in the same orientation to create a repetitive weave pattern. Figure 2a shows such an arrangement. Arrange the modules randomly to create a non-repetitive pattern. Figure 2b shows the modules arranged randomly so that the weave pattern is non-repetitive.

The steps illustrated in Figures 5, 6, and 7 can be applied to the strings with other module boundary shapes. As another example, to create an alternate embodiment

of the present invention with triangular modules of area, after completing the process up to the condition shown in Figure 4, proceed as follows:

Establish a boundary in the shape of an equilateral triangle around a portion of the woven string pattern. Figure 8 shows a triangular boundary (10) around the randomly woven strings (5), (6), (7), and (8) from Figure 4. Notice that Figure 8 is substantially identical to Figure 5, with the exception of the square and the triangle.

As with the square element, move the strings that pass through the boundary so that their intersections with the boundary are evenly divided between the edges. Strings may need to be added or taken away to accomplish this division, and if this is necessary, make sure to provide the woven intersections over and under the other strings. Figure 9 shows the strings' boundary intersections divided between the edges evenly. String (6) has been removed to accomplish the operation because eight intersections with the boundary cannot be evenly divided between three edges. Similarly, depending on the number of strings used, strings may be added to accomplish the even division.

As with the square module, arrange the intersections of the strings with the edges so that on an edge, the intersections are spaced evenly from the midpoint of the edge and make sure that the intersections to the edges form an angle perpendicular to the edge. Again, this will provide the basis for a simple module, but a more complex version can be made with intersections at other angles, provided that from one edge to the next, the intersections' angles are repeated around the boundary on each edge.

From one edge to the next, arrange the spacings so that they are identically spaced. Figure 10 shows the triangular module of area with the string intersections with the edges properly spaced around the boundary. Figure 10 is now a triangular module that can be used in an assembly of virtually identical modules to create a weave design that is repetitive or non-repetitive.

As with the square module, arrange a collection of the triangular modules into an overall weave design. Figure 11 shows a weave pattern made with the triangular modules shown in Figure 10.

Other shapes can be used to make similar surface weave designs. A hexagonal module can be used on a flat surface, and when pentagonal modules are used to cover a three-dimensional surface, the same method may be used to create a weave design over the surface.

Figure 12 shows a predominantly square four-sided module of area made with curved edges (11) that mate with adjacent modules edge-to-edge without leaving holes between them. Use the steps illustrated in Figures 5, 6, and 7 to create the module of area wit this shape. As with the square boundary, the strings (5), (6), (7), and (8) from Figure 4 again) intersect the edges in a controlled manner, with the same constraints described for Figures 6 and 7.

OPERATION

Figure 13 is a drawing of a patio constructed from paver stones designed with the present invention. The patio has been assembled with deliberate orientations of the modules resulting in some symmetry without overall repetitiveness in the design. Identical modules were used to construct the design, but the design does not appear to have a frequency of repetition equal to the number of modules. Random orientations of the pavers would result in a randomized weave pattern, but the appearance of the strings alternately passing over and under each string intersected would be maintained.

The module shown in Figure 7 could be deemed complete. However, it is often desirable to put more ornamentation into the module background (2). One may thus fill the strings or background with a color, or with a subsidiary design element. The use of such a design element is not integral to the principle of the invention, but may be added to enhance the clarity or the aesthetic appeal of the design.

Because this process is able to generate such a variety of forms, and at the same time is able to maintain a high degree of unity, the process has many applications within the design industries.

For example, the present invention can be used in interior design. One example of such use is in making ceramic tiles, paver stones for patios, or floor tiles. Figure 13 is a drawing of paver stones made using the present invention assembled into a modular patio for landscaping. The advantage of the present invention, when used for this purpose, is that only one design for one tile needs to be created, yet the overall design does not repeat itself, and many variations of the design can be formed by distributing the tiles randomly or with deliberate order.

The design of the present invention can also be used in decoration of fabrics, on wallpaper, on decorative cinder blocks, for use in the construction industry, and

in decorative wrapping paper and packaging. In general, it can be used to decorate virtually any two-dimensional surface, including two-dimensional surfaces that occupy a three-dimensional space (such as a fabric). In the above examples, the design is permanently affixed to a substrate, such as a wall, a floor, or the surface of a piece of furniture.

The process of the present invention can also be used to construct a toy or puzzle consisting of a set of squares, or other regular polygons, which fit within a frame. A simple case would be that of sixteen squares that fit into a square frame, each square having a design made according to the method described with respect to Figures 3 to 7. The appearance of the entire puzzle is changed every time the orientation of a square is changed. The puzzle can be an educational toy, a conversation piece, or a decoration for home or office, or all of the above.

Another use of the present invention is in making a toy or decorative item having the form of a set of cubes, similar to the device popularly known as the "Rubik's cube". For example, one can make 27 identical cubes, capable of being fitted together to form one large cube, each cube having identical designs on each side, but with differing orientations. The design on each side is made according to the method described with respect to Figures 3 to 7. The cubes could be turned individually; thereby changing one of the squares of the design, and thus creating an overall weave design having a new appearance. This product could also serve as an educational toy, a decoration, a conversation piece, or any or all of these. One could also make a set of blocks which are not fastened into a cube, but which contain the basic module on each side, and which can be arranged in patterns of endless variety.

Furthermore, the entire design process can be performed by a computer, or by other mechanical means. It is a simple matter to program a computer to proceed through a large set of configurations of points, to generate connecting thick lines, use logic to create the alternating over/under weave appearance of the thick lines, and to fill in selected spaces. The program would include a step to insure that the design of the module is asymmetric, and to reject those modules whose designs turn out to be symmetrical. The resulting modules can be used to build elaborate and original designs.

After a design for a module is chosen, the computer can also be used to assemble the modules randomly form the larger pattern.

A computer can also be used to generate a moving design that can be used as an art form. That is, the computer can be programmed to display an orientation of a

plurality of identical modules, made according to the invention, and to vary continuously the orientation of one or more modules of the large weave design. The viewer can watch a screen, or other display device, while the large weave design changes with time. Each change in the design would be due only to the change in orientation of one or more modules. In other words, the computer can be used to generate one or more realizations of the weave design, and can be programmed to display an ordered or random sequence of such realizations.

The method for creating the modules can be used to create woven patterns of animal or human forms, grass weave, grape vines, ropes, train tracks, and an endless variety of other decorative forms.

While the invention has been described with respect to certain embodiments, it is understood that the invention is not intended to be limited to what is shown. The designs can be complemented with various conventional design elements, such as granular texture, or porous surface treatment, or color to provide enhancement to the visual appeal.